One thing leads to another: Causal chains link health, development, and conservation

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The linkages between environmental health and human well-being are complex and dynamic, and researchers have developed numerous models and theories for describing them. They include attempts to bridge traditional academic boundaries, uniting fields of study under rubrics such as social-ecological frameworks, coupled human and natural systems, ecosystem services, and resilience theory. However, these efforts have been constrained by varying practices and a failure among practitioners to agree on consistent practices.

Writing in *BioScience* , Jiangxiao Qiu of the University of Florida and his colleagues describe this state of affairs and propose an alternative and practical approach to understanding the interplay of social and ecological spheres: causal chains. The authors describe these chains as an "approach to identifying logical and ordered sequences of effects on how a system responds to interventions, actions, or perturbations." And although causal chains are well established in many fields, the authors highlight that "there is no normative consensus about the principles and guidelines necessary to create causal chains relevant for dealing with human-nature challenges."

By refining and standardizing the causal [chain](#) methodology, the authors hope that the drivers of human behavior, and inherently linked social and ecological outcomes can be better understood—and then acted on. For instance, the authors cite an example of a biophysical system in Kenya in which forests are converted to farmland without the supply of additional nutrients. Without intervention, the consequent soil degradation then

results in "food insecurity and reduced household income, while further accelerating the degradation of the remaining forests." By viewing this cycle through the lens of causal chains, managers might be better able to see ways to break it.

Qiu and his colleagues describe a three-phase system for identifying and working with causal chains, designed to permit the assessment of current systems and their responses to management actions. Possible targets for study include food production and pollution interactions, land-use change and its effects on local populations, and the responses of natural and social communities to climate-change-induced severe weather events.

The authors aim to establish "a common framework to understand the dynamics and interactions of coupled human-natural systems, to support evidence-based decision-making, and to serve as a transformative approach for systems integration in the new era of complex human-nature linked research, practice, and policy."

Causal chains may also serve as a platform for the synthesis of many lines of evidence that are necessary to address shared problems. If causal chains are well described and heeded in policy and management efforts, the authors hope that they might "unite actions across a range of players, including researchers, managers, decision-makers, and different stakeholders for allied and shared actions fundamental for achieving prominent sustainable development goals."